Autopathic Effect of Capsaicin (8-methyl-N-vanillyl-6-nonenamide) on *Capsicum annuum* L. Seed Germination

Derek W. Barchenger and Paul W. Bosland

Department of Plant and Environmental Sciences,
New Mexico State University, Las Cruces NM 88003, USA.

Introduction

Recently, there has been an increase in popularity of a new class of chile peppers (*Capsicum* spp.) called "super hots" that have more than 1,000,000 Scoville heat units. However, it has been observed that germination of "super hot" chile pepper seed is slower and is reduced, as compared to other chile peppers with lower heat levels.

Germination is a principal component of seedling establishment and survival. After imbibition, radicle emergence is the first visible step in seed germination and is considered a valuable evaluation of seed vigor in crops.

Objective

To determine the effect of capsaicin on chile pepper seed germination and develop a wash protocol to remove capsaicinoids from seeds of "super hot" chile peppers.

Materials and Methods

Plant material: Seeds of 'Keystone Resistant Giant' and 'Pimiento L.' were used for capsaicin (8-methyl-N-vanillyl-6-nonenamid) treatment, because they do not have detectable levels of capsaicin. Seeds of 'Trinidad Moruga Scorpion' were used for the washed experiment.

Treatments: 0, 500, and 1,500 ppm capsaicin solution were made by dissolving pure capsaicin in 10 mL of 95% ethanol (0.0, 0.053, and 0.158 g, respectively). The capsaicin solution was then added to 90 mL of deionized water. Filter paper was then moistened with 15 mL of the specific treatment solution. Electrical conductivity (EC) was measured on all treatment solutions

Washes: Seeds were washed in 50 mL of water, and the organic solvents ethanol, methanol, acetonitrile, or acetone to remove capsaicinoids for 30 seconds, then rinsed with tap water.

Germination conditions: All seeds were placed at 25 °C for 20 days, and scored daily. Germination was recorded when radicle emergence reached ≥2 mm.

Experimental design and statistical analysis: Experimental units were individual seeds in a completely randomized design. Four replications of 100 seeds each were used. Tukey's HSD was used for mean separation (significant $P \leq 0.05$).

Results

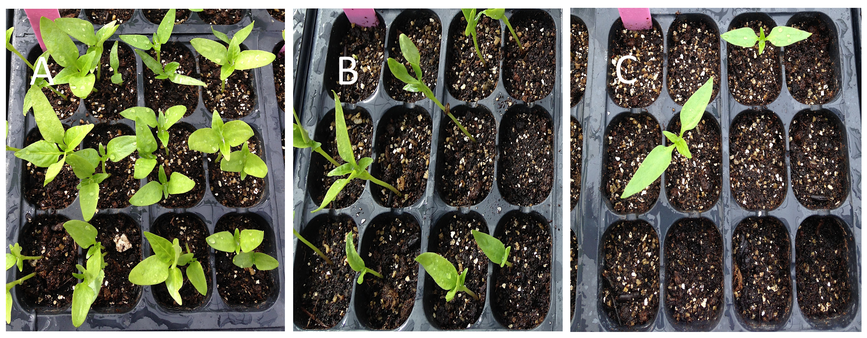

Fig. 1. Germination of 'Keystone Resistant Giant' seed treated with 0 (A), 500 (B), and 1500 (C) ppm capsaicin after 20 days at 25 °C and 85-95% relative humidity.

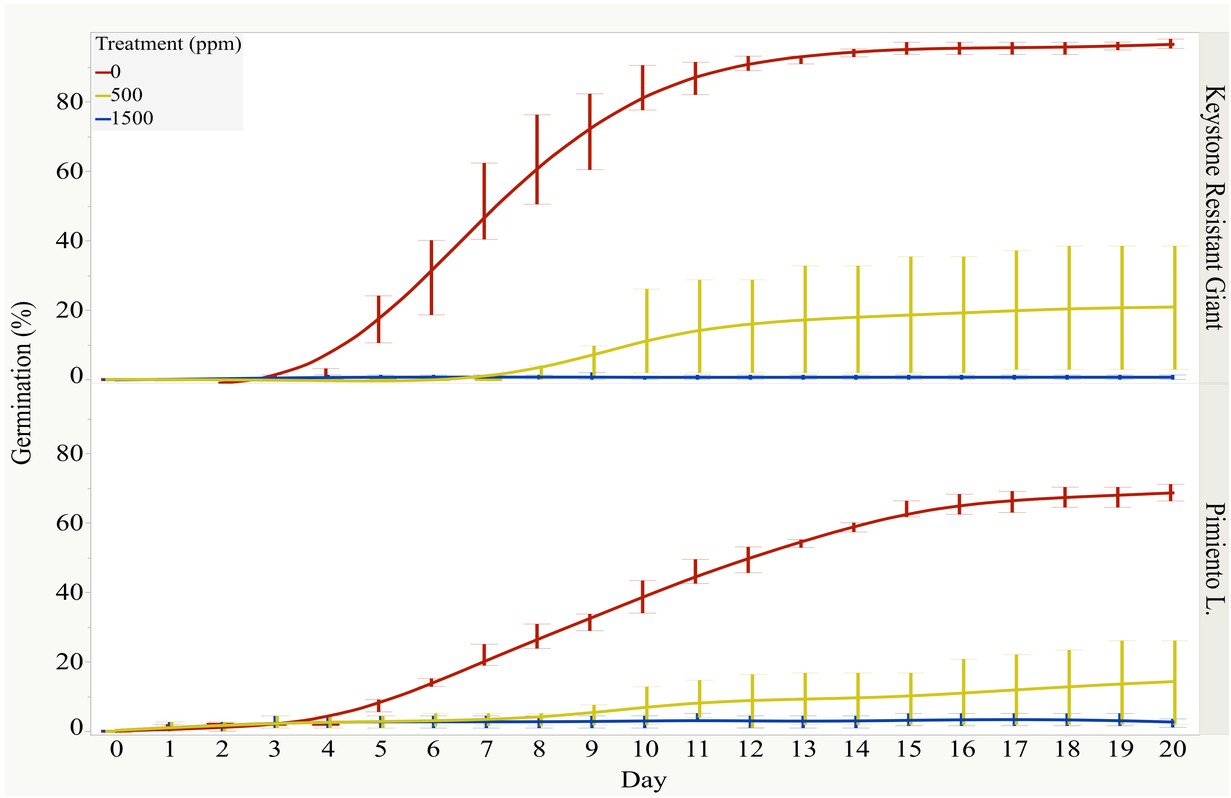

Fig. 2. Percent germination of 'Keystone Resistant Giant' and 'Pimiento L.' seeds treated with 0, 500, and 1500 ppm capsaicin grown for 20 days at 25 °C and 100% relative humidity. Each SE bar was constructed using 1 SEM.

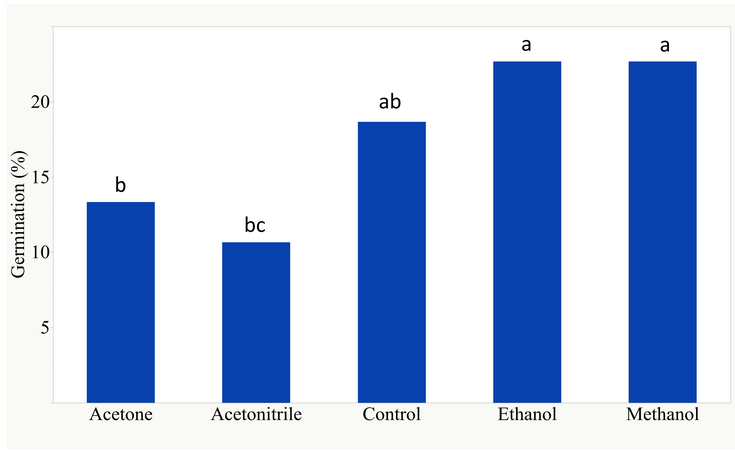

Fig. 3. Percent germination of 'Trinidad Moruga Scorpion' seeds washed with water (control), and the organic solvents acetone, acetonitrile, ethanol, and methanol, after 20 days at 25 °C and 85-95% relative humidity. Bars with the same letter are not significantly different at $P \leq 0.05$.

Discussion

The electrical conductivity of the 500 and 1500 ppm capsaicin solutions was not high enough (16.5 and 32.4 $\mu S \bullet cm^{-1}$, respectively) to reduce percent germination.

Capsaicin had a major inhibiting effect on seed germination, illustrated with an F-ratio of 706.1. Capsaicin treatment resulted not only in reduced and slowed germination (Figs. 1 and 2), but also in inconsistent germination, illustrated by large error bars.

We were unable to successfully remove capsaicinoids from the 'Trinidad Moruga Scorpion' seeds with organic solvent washes and improve germination. In fact, wash of acetonitrile may have caused embryo injury, thus reducing germination (Fig. 3).